

FABRICATION AND DESIGN OF MONOBIKE

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ABSTRACT

In this paper the work has been done on mono bike RYNO which is based on the concept of unicycle. This machine can beat the problem of driving energy source as well as pollution as they are the key problems of modern time. Mono wheel can be used in various places such as industries to travel between various working sites, in transportation, and in public areas also. Here in this project we are going to make the hardware of mono bike, which we can drive as similar to bike but with few skills as it is a unibike. In this bike self-balancing technique will be used with the help of microcontroller, gyrosensor and accelerometer. The microcontroller is Arduino uno which will run at 16MHz. The main objective of this work is to reduce the cost of bike upto large extent and also to maintain stability on practical basis.

KEYWORDS: Monobike, RYNO, MPU6050, MEMS Accelerometer and Gyroscope & Arduino Un

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INTRODUCTION

Mono wheel is a concept in which the driver is supposed to sit on or inside the single wheel with the understanding of self-balancing technique. Mono wheel has an advantage in comparison to bicycle or bike that it is farther more efficient as it contains less frictional losses over the wheels. In this paper specifically RYNO mono bike has been discussed regarding its design and fabrication.

RYNO Monobike

RYNO is a mono bike that consists of only one wheel and it is powered electrically with the help of batteries. RYNO is basically capable of running at speeds of 10miles per hour. It was made by Portland based engineer Chris Hoffmann made the first prototype of RYNO when his daughter told him about his fictional story of one wheeled motorcycle.

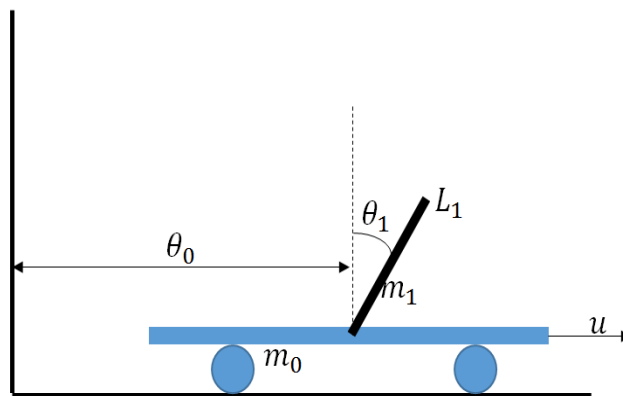
The real meaning suggested for the abbreviation RYNO by Chris was “Ride Your New Opportunity”.

EQUIPMENT Required

There are many equipment required for the fabrication of mono bike in which the important things a suitable tyre which can provide the stability factors along with electrical components most importantly such as BLDC motor which will act as driving source, battery as a energy source and gyrosens or in addition to accelerometer to determine exact data about linear and rotational motion of bike without which it is very tough to maintain the stability of bike; these are few main parts of the bike which are uncompromised. Details of few components is as followed:

Table 1: Specifications of Components Used

S. No	Items		
	Name	Quantity	Specification
1	Tyre	Single	145/70 R12
2	Motor	Single	250Watt, 48 Volt
3	Battery	Four	12 Volt, 24 Amp
4	MPU 6050	Single	Six axis gyrosensor + accelerometer
5	Speed controller	Single	250Watt, 48 Volt
6	DC to DC converter	Single	250Watt, 48 Volt
7	Arduino UNO	Single	16MHz

Inverted Pendulum Theory**Figure 1: Basic Model of Inverted Pendulum**

In figure (1) the basic model for applying the inverted pendulum theory has been shown. In this figure few variables has been used which can be defined

m_0 = Mass of cart

m_1 = Mass of rod

L_1 = length of rod

θ_0 = Distance between centre of cart and the left wall

θ_1 = Rod's angle of deviation from the vertical axis

u = Force to be applied on the cart

I = Retarding force regarding mass

Here it is to be assumed that there is no friction between the cart and therefore the floor. Main objective of this modeling is to make equation so that the system can be make to run. Here this goal will be determined with the help of lag range equation. With the help of these equations, this model has been applied to the monobike so that stability of bike regarding its mechanical design can be maintained because the sensor can provide stability but before that the designer have to keep the mechanical part of bike in control.

FABRICATION OF BIKE

Fabrication Part

Table 2: Design Elements in Bike

S. No	Items	Specification
1	Tyre	145/70 R12
2	Metal sheet	Iron sheet 18 gauge 8x4
3	Ss square pipe	1.5 inch, 1 pipe
4	Ss strip	2 inch 3 sut, 5 feet
5	Brake	Drum brake

The foremost work in framing this bike is designing in which there is need to draw the model of the bike so that following that model bike can be designed. After designing the model of bike it needs the selection of material from which the basic frame of bike will be made so that the bike could be made strong along with light weighted from the point of stability. The basic model of bike seems like this as in figure (2).



Figure 2: Fundamental Frame

As in figure (2) the basic model has been shown after fabricating this model bike is modified and while modifying few factors has been kept in mind while modifying it such as the back side of bike has been designed such that stability can be maintained while sitting also. Modification of the bike needs its complete denting and painting so as to provide it a new look. Modified can be seen as in figure (3).



Figure 3: Modified Bike

But just modification is the only mechanical part of the bike which can't make this bike complete because still the electrical part of the bike is remained.

Controlling Part

In controlling part of the bike first the MPU6050 will be used with Arduino UNO board so that the sensor can detect the angle of tilt of the bike and along with this accelerometer installed in the same sensor will help to calculate the amount of acceleration. The block diagram which have to be followed while making all the connections is as shown in figure (3):

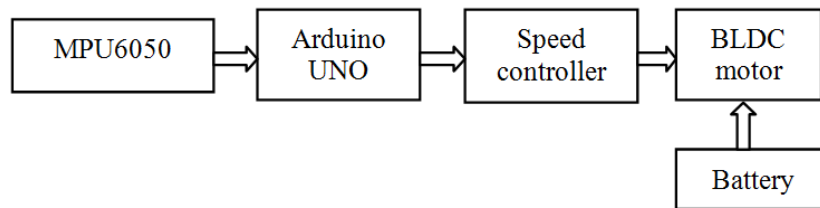


Figure 3: Block Diagram for Controlling and Functioning

For all this work it needs to work first on a prototype so that any problem can be avoided occurring on a whole bike. In this prototype programming related to MPU 6050 and controlling of the bike with respect to stability will be done on Arduino software so that the results can be obtained visually. The controlling circuit which is been used is shown in figure (4):

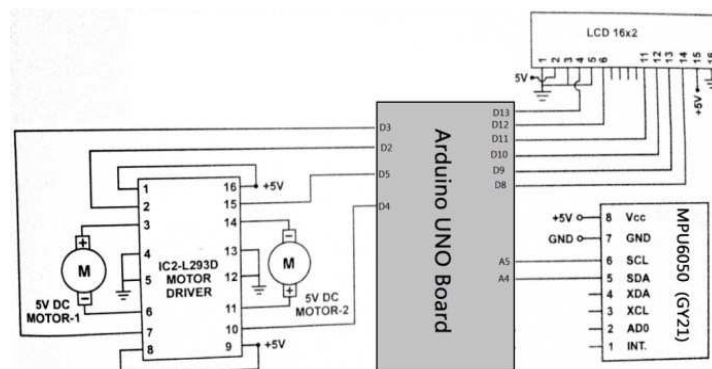


Figure 4: Controlling Circuit with all Electrical Components

According to this circuit all the connections done and then it was applied to the bike after the suitable results related to stability obtained.

RESULTS AND DISCUSSIONS

After doing complete programming and connections the following results have been obtained that can be shown as:

Table 3: Final Results

S. No.	Parameter	Specification
1.	Power	1152wps
2.	Mileage	150 km
3.	Stability	$\pm 10\%$
4.	Overall cost	23,592

According to the aim of our project maintaining stability as much as possible and reduction of cost of the bike so that this bike could make economical. From this project we have obtained the power in terms of 1152 watts per second and mileage in range of 150km.

The stability that we have tried to gain is between +10% to -10% with the help of microcontroller and gyrosensor. Most important fact about this project is cost factor where the result has been obtained as 23,592 rupees. In this economical value bike can be afforded by a common person and if compared to the other sources than this bike should be brought because it is less costly in terms of a uniqueness as the inventor of this bike has kept the retail value of this bike in terms of dollar 2995\$ and if it will brought to India then extra cost of duty will also added then the overall cost will be increased which will become very costly in our country.

After doing the ride we tried to achieve the stability as we are not as skilled and first time rider also so started the bike and carried the bike at the speed of 20 km/hr and slowly achieved the speed of 40km/hr.

CONCLUSIONS

Here it has been concluded after making this bike that this vehicle has now the ability that it balances itself by moving the device in the forward direction or backward direction base on the basis of readings provided from sensors. Mono bike is very practically viable also from the economic point of view also as the cost determined in this bike is 23,592 rupees. Mono bike is much helpful in the large campuses like airports, universities, space centers and in large industries where rider need to cover less distances and in narrow areas. Mono bike suggested in this experimental project is made with all efforts to make it economical and practical as much as possible so that it can be used in practical life also with time evolving advancements making it more soft to run.

FUTURE SCOPE

There are many future scopes for this object as it don't contain only a small area of interest which can be suggested as:

- Its stability can be more improved with the help of ROLY-POLY toy theory, in this it is observed that the whole weight of toy is on centre of gravity such that even after disturbing and applying the pushing force toy do not tend to fall down and maintains its position back as it is; hence this phenomenon can be employed in the self sustaining stability of bike.
- Proximity IR sensor can be use in mono bike so as to warn the bike in case of danger from any side with the help of alarm if the budget is low.
- Similar to the car intelligent parking assist system can be used in bike also in which sonar system, backup cameras and some additional sensors are also used. But there is a limitation for this system; this system can be used only if the budget is quiet good.

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AUTHOR DETAILS

Shatakshi Singh pursuing **M. Tech** in Electrical Engineering with Specialization in electrical engineering from Shri Ram Murti Smarak College of Engineering and Technology, Bareilly, India. I have completed my B. Tech in Electrical Engineering from Shri Ram Murti Smarak College of Engineering and Technology, Bareilly with 69.8% in 2015. I did my schooling from Sarla Devi Saraswati Balika Inter College, Tilhar, Shahjhanpur.

I have published my paper “Review of RYNO monobike” IJEER, 2019.

I have knowledge of MATLAB/SIMULINK software and ARDUINO software which I have used in my project work in my capacity.

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